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***Simulium (Gomphostilbia) hoiseni* sp. nov. (Diptera: Simuliidae): a new species from Peninsular Malaysia**

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Abstract: A new simuliid species, *Simulium (Gomphostilbia) hoiseni* sp. nov., is described on the basis of the male reared from a pupa collected from Cameron Highlands, Peninsular Malaysia. This new species is assigned to the *ceylonicum* species-group of the subgenus *Gomphostilbia*. It is characterized in the male by the abdominal segments 2–9 each with a pair of shiny patches dorsolaterally as well as the enlarged hind basitarsus, and in the pupa by six gill filaments of which the middle and ventral groups of filaments share a common stalk.

Key words: Simuliidae, *Simulium*, Malaysia, new species

In Peninsular Malaysia, the subgenus *Gomphostilbia* Enderlein in the genus *Simulium* Latreille s.l. is one of the two large groups consisting of 17 of the 38 species so far recorded (Takaoka and Davies, 1995, 1997; Takaoka and Adler, 1997). Within this subgenus, the *ceylonicum* species-group is represented by three species: *S. (G.) asakoae*, *S. (G.) longitruncum* and *S. (G.) sheilae*, all described by Takaoka and Davies (1995). During surveys on the immature stages of black flies in Cameron Highlands, Peninsular Malaysia, one more species of this species-group was collected. It is characterized by six pupal gill filaments instead of the usual eight filaments.

This is here described as a new species on the basis of the male adult (reared from a pupa) and its associated pupal exuvia.

The terms for morphological features used here follow those of Takaoka (2003). Holotype specimen of the new species is deposited at the Department of Infectious Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

***Simulium (Gomphostilbia) hoiseni* sp. nov.**

DESCRIPTION. **Male.** Body length 2.5 mm. **Head.** Nearly as wide as thorax. Upper eye consisting of 10 or 11 vertical columns and 13 horizontal rows of large facets. Face dark brown, white pruinose. Clypeus dark brown, moderately covered with yellow simple long hairs interspersed with several dark brown simple long hairs along each lateral margin. Antenna composed of 2+9 segments, yellow to ochreous though apical 4 or 5 flagellar segments darker than others; 1st flagellar segment elongate, 1.73 times as long as 2nd flagellar segment. Maxillary palp composed of 5 segments; proportional lengths of 3rd, 4th, and 5th segments of left palp 1.00 : 1.11 : 2.65; sensory vesicle (Fig. 1A, B) 0.14 or 0.15 times as long as 3rd segment, nearly globular, and with small or medium-sized opening. **Thorax.** Scutum medium to dark brown (except anterolateral calli ochreous), with very faint 3 dark longitudinal vittae, thinly whitish-gray pruinose broadly along lateral margin and prescutellar area at certain angle of light, shiny and densely covered with yellowish-white scale-like recumbent hairs (bright shiny when illuminated). Scutellum medium brown, moderately covered with yellowish-white short hairs and dark

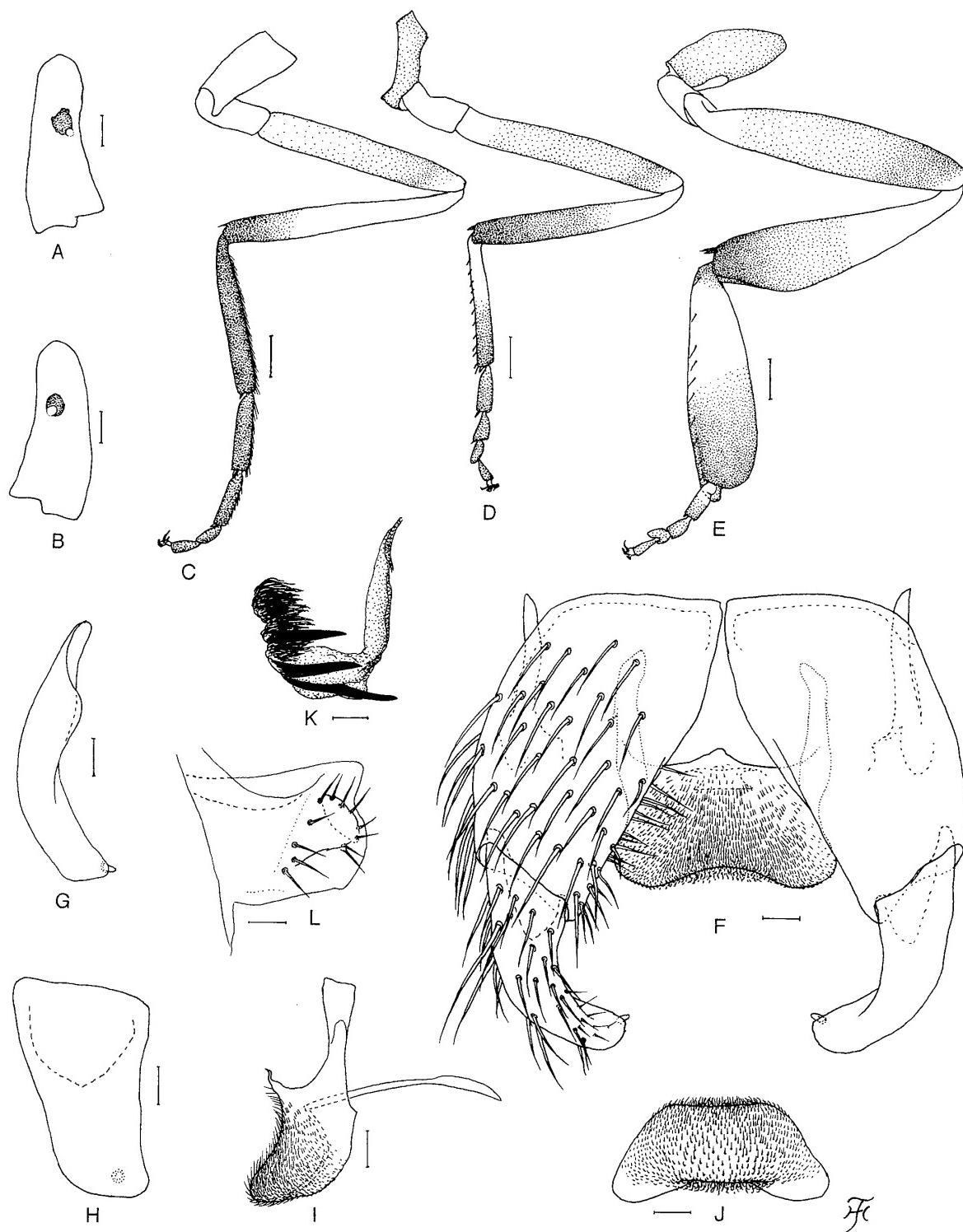


Fig. 1. Male of *Simulium (Gomphostilbia) hoiseni* sp. nov. A and B, maxillary palps with sensory vesicle (front view; A, right side; B, left side); C-E, legs (outer view; C, foreleg; D, midleg; E, hind leg); F, coxites, styles, ventral plate and median sclerite *in situ* (ventral view); G and H, styles (right side; G, medial view; H, ventrolateral view); I, ventral plate and median sclerite (lateral view); J, ventral plate (end view); K, paramere (right side; dorsal view); L, 10th abdominal segment with cercus (right side; lateral view). Scale bars. 0.1 mm for C-E; 0.02 mm for A, B, and F-L.

brown long upright hairs. Postnotum dark brown, whitish-gray pruinose at certain angle of light, shiny and bare. Pleural membrane

bare. Katepisternum dark brown, longer than deep, shiny at certain angle of light, moderately covered with yellow hairs as well as dark

brown hairs. **Legs.** Foreleg (Fig. 1C): coxa and trochanter yellowish-white; femur light to medium brown though base of inner surface yellowish-white; tibia white except apical 3/10 dark brown; outer surface widely shiny when illuminated at certain angle of light; tarsus dark brown, with moderate dorsal hair crest; basitarsus slightly dilated, 7.6 times as long as its greatest width. Midleg (Fig. 1D): coxa medium brown except posterior surface dark brown; trochanter yellowish-white; femur light to medium brown with base yellowish-white; tibia medium brown with basal 2/5 yellowish-white; tarsus medium brown except basal 1/2 of basitarsus yellowish. Hind leg (Fig. 1E): coxa medium brown; trochanter yellowish-white; femur medium brown with base yellowish-white and apical cap dark brown; tibia dark brown to brownish-black with a little less than basal 1/2 white; tarsus medium brown except a little less than basal 1/2 of basitarsus and of 2nd tarsal segment white; basitarsus in outer view (Fig. 1E) enlarged, nearly wedge-shaped, gradually widened from base to a little beyond middle, then very slightly narrowed toward apex, 3.36 times as long as greatest width, and 1.04 and 1.24 times as wide as greatest widths of tibia and femur, respectively; calcipala small, 0.75 times as long as its basal width and 0.29 times as wide as greatest width of basitarsus. **Wing.** Length 2.1 mm. Costa with dark spinules as well as dark hairs except basal batch of hairs mostly yellow. Subcosta bare. Hair tuft on stem vein mostly yellow. Basal portion of radius fully covered with dark hairs. Basal cell absent. **Abdomen.** Basal scale dark brown, with fringe of light brown long hairs though apical portions yellowish. Dorsal surface of abdomen medium to dark brown except basal 1/2 of 2nd segment yellow, moderately covered with dark hairs (though mixed with yellow hairs on anterior segments); segments 2–9 each with pair of shiny iridescent dorsolateral patches usually connected in middle widely or narrowly, though those of segments 3 and 4 relatively small, restricted along anterior margin; ventral surface of abdomen medium brown except those of segments 2 and 3 yellowish-white. **Genitalia.** Coxite in ventral view (Fig. 1F) rectangular, 1.9 times as long as wide. Style in ventral view (Fig. 1F) short, 0.7 times as long as coxite, curved inwards, and with apical spine; style in medial view (Fig. 1G) nearly parallel-

sided, gently bent inward; style in ventro-lateral view (Fig. 1H) broad basally, gradually narrowed toward apex, and with truncated apex. Ventral plate in ventral view (Fig. 1F) transverse, 0.6 times as long as its greatest width, with anterior margin produced medially, and with posterior margin and lateral margins widely convex medially, and densely covered with microsetae on ventral surface; basal arms of moderate length, slender, nearly parallel-sided; ventral plate in lateral view (Fig. 1I) somewhat produced ventrally; ventral plate in end view (Fig. 1J) trapezoid-shaped, and densely covered with microsetae on posterior surface. Median sclerite (Fig. 1F) thin, plate-like, widened near apex. Paramere (Fig. 1K) of moderate size, with 3 distinct stout hooks. Aedeagal membrane moderately setose; dorsal plate undeveloped. Ventral surface of 10th abdominal segment (Fig. 1L) without hairs near posterior margin on each side. Cercus in lateral view (Fig. 1L) rounded, with 12 or 13 hairs.

Pupa. Body length 3.0 mm. **Head.** Integument (Fig. 2A) yellow, densely and neatly covered with round tubercles on frons and on each lateral surface of face but almost bare on antennal sheaths and ventral surface of face; antennal sheath normal, with no spinous projections; face with pair of simple (right side) and bifid (left side) long trichomes, and frons with 3 pairs of simple long trichomes; 3 frontal trichomes on each side arising somewhat close together, subequal in length to one another, and slightly longer than facial ones. **Thorax.** Integument yellowish, densely and neatly covered with round tubercles, with 3 pairs of simple long trichomes with coiled apex (subequal to or a little longer than those on frons) anterodorsally, with 2 pairs of simple trichomes (1 long with coiled apex, 1 medium-long with uncoiled apex) anterolaterally, with 1 pair of simple medium-long trichomes with uncoiled apex posterolaterally, and with 3 pairs of simple short trichomes with uncoiled apex ventrolaterally. Gill (Fig. 2B, C) composed of 6 slender filaments arranged in 2+(2+2) filaments from dorsal to ventral on left side (Fig. 2B) and in 2+[1+(1+2)] filaments from dorsal to ventral on right side (Fig. 2C); common basal stalk medium-long, slightly shorter than interspiracular trunk, though slightly thicker than it, and with round transparent organ ventrally at base; all filaments

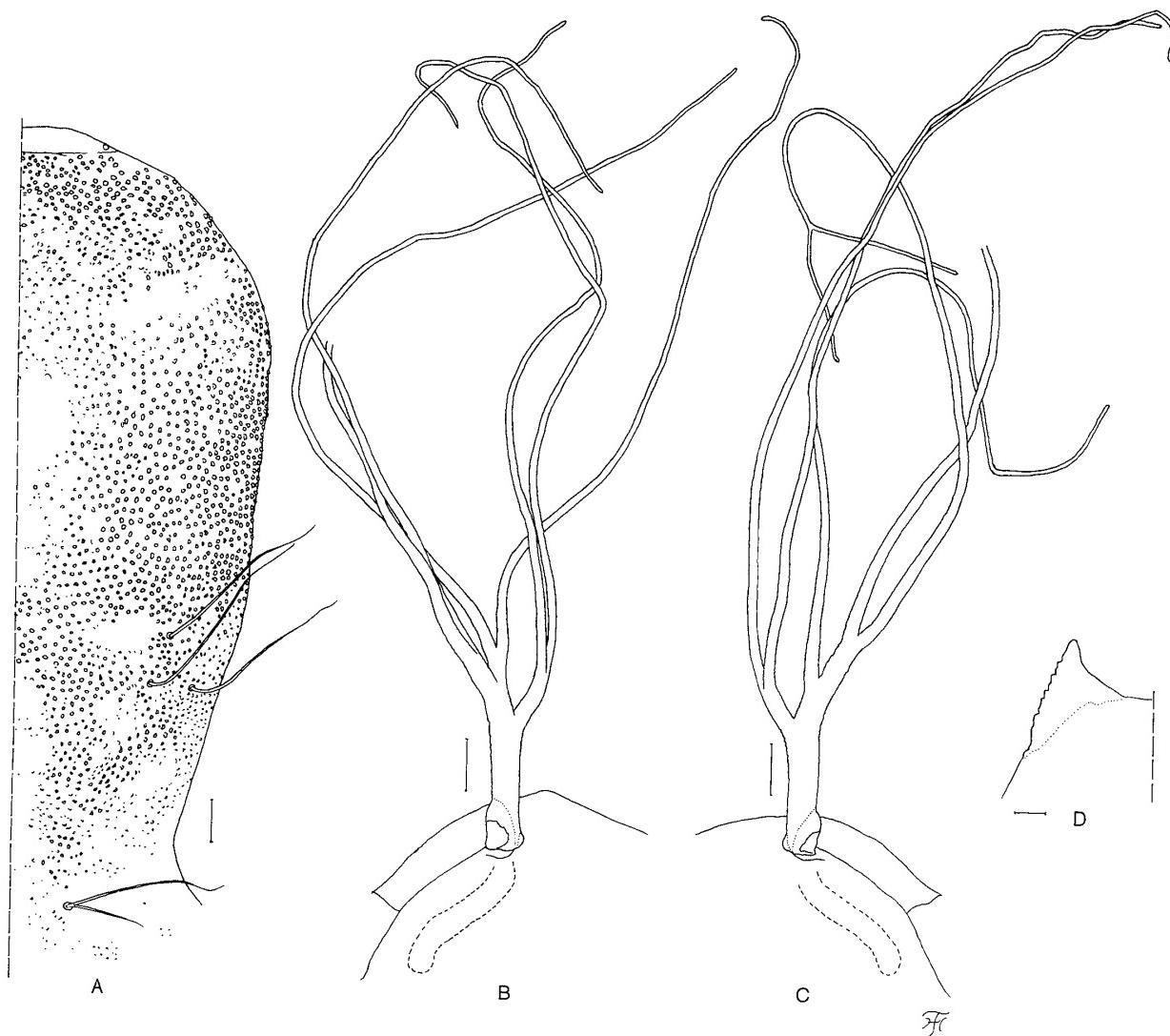


Fig. 2. Pupa of *Simulium (Gomphostilbia) hoiseni* sp. nov.

A, frons and part of face densely covered with tubercles (left half); B and C, gill filaments (outer view; B, left side; C, right side); D, terminal hook (left side; end view). Scale bars. 0.1 mm for B and C; 0.04 mm for A; 0.02 mm for D.

subequal in length (length from base of gill to tip 1.8–2.2 mm) and thickness (though two filaments of ventral pair of left gill very slightly thicker than others), yellowish, gradually tapered toward apical tip, with distinct annular ridges and furrows, and covered with relatively larger tubercles on ridges and smaller ones on interridge spaces. **Abdomen.** Dorsally, segments 1 and 2 yellowish and sparsely covered with minute tubercles near anterior margin; segment 1 with 1 medium-long simple slender seta on each side; segment 2 with 1 medium-long simple slender seta and 5 very short slender setae on each side; segments 3 and 4, each with 4 hooked spines and 1 very short slender seta on each side; segment 5 lacking spine-

combs; segments 6–9 each with distinct spine-combs in transverse row, together with comb-like groups of minute spines on each side; segment 9 with pair of plate-like terminal hooks with outer margin weakly serrated (Fig. 2D). Ventrally, segments 4 and 6–8 with comb-like groups of minute spines; segment 4 with a few very short simple slender setae on each side; segment 5 with pair of bifid hooks submedially and a few very short simple slender setae on each side; segments 6 and 7 each with pair of bifid inner and simple outer hooks somewhat spaced from each other and a few very short simple slender setae on each side. Segment 9 with 2 or 3 grapnel-like hooklets on each lateral side. **Cocoon.** Lost.

Female and Mature larva. Unknown.

TYPE SPECIMEN. Holotype male (with its associated pupal exuvia), reared from a pupa collected from a small stream (width about 1.0 m, water temperature 17.0°C, exposed to sun, altitude 1,570 m) moderately running in a tea plantation, about 100 m above from Sungai Palas, Cameron Highlands, Peninsular Malaysia, 13. III. 1996, by H. Takaoka and A. Takaoka.

ECOLOGICAL NOTES. The pupa of this new species was taken from a leaf of the trailing grass in the water. Associated species was *S. (G.) asakoae*.

ETYMOLOGY. The species name *hoiseni* is in honor of Academician Dr. Yong Hoi Sen, Senior Fellow, Academy of Sciences Malaysia and Professor Emeritus, University of Malaya, who kindly helped in the field surveys in 1996 and 1998, and in giving valuable comments on the manuscript.

REMARKS. *Simulium (G.) hoiseni* sp. nov. is assigned to the *ceylonicum* species-group of the subgenus *Gomphostilbia* because the male has an enlarged hind basitarsus (Fig. 1E). This new species is characterized by the pupal gill with six slender filaments (Fig. 2B, C), a character rarely occurring in the *ceylonicum* species-group and so far found in three species, viz., *S. (G.) rosemaryae* Takaoka and Roberts from Sulawesi (Takaoka and Roberts, 1988), *S. (G.) kamimurai* Takaoka from Sulawesi and Seram (Takaoka, 2003) and *S. (G.) udomi* Takaoka and Choochote from Thailand (Takaoka and Choochote, 2006).

The male of *S. (G.) hoiseni* sp. nov. is easily separated from those three species in that the tibia and basitarsus of the hind leg are whitish-yellow or white on a little less than basal 1/2 in this new species but on the basal 1/3 to 2/5 in the three known species; and also in that a pair of shiny dorsolateral patches is found on each of

the abdominal segments 2–9 in this new species but on each of the abdominal segments 2 and 5–7 or of the abdominal segments 2–7 in the three known species.

The smaller number of large eye facets and the bare subcosta separate *S. (G.) hoiseni* sp. nov. from *S. (G.) udomi*, which has large eye facets in 13 vertical columns and 16 horizontal rows, and the haired subcosta.

In the pupal stage, this new species is also easily distinguished from the three known species by the arrangement of the gill filaments, i.e., middle and ventral groups of filaments share a common stalk (Fig. 2B, C) (cf., dorsal and middle groups share a common stalk in the three known species), and also by the frons densely covered with tubercles (Fig. 2A) (cf., moderately or sparsely in the three known species).

Apart from the difference in the number of the pupal gill filaments, the male of *S. (G.) hoiseni* sp. nov. is very similar to *S. (G.) asakoae* in many features including the number of large eye facets and the color of legs but is distinguished from the latter species by the bare subcosta and the abdominal segments 2–9 with a pair of shiny dorsolateral patches. The relatively long common basal stalk coupled with the sharing of the common stalk by the middle and ventral groups of the pupal gill filaments as seen in this new species has been reported in three species, viz., *S. (G.) longitruncum* from Peninsular Malaysia (Takaoka and Davies, 1995), *S. (G.) miyagii* Takaoka and *S. (G.) serratum* Takaoka, both from Sulawesi (Takaoka, 2003), but all these known species have many different characteristics including the pupal gill with eight filaments.

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